# RECIPROCATING ENGINES Peer Review Meeting Chicago, Illinois April 23-24, 2002



### National and State Environmental Issues: Implications for Reciprocating Engines

Timothy A. French
Legal Counsel
Engine Manufacturers Association
Two North LaSalle Street
Suite 2200
Chicago, Illinois 60602
tfrench@ngelaw.com



- Reciprocating internal combustion engines (RICE) are uniquely suited to play a key role in the development and deployment of advanced distributed energy (DE) systems.
- RICE are especially well-suited to smaller DE applications (<u>i.e.</u> less than 5MW), as other technologies are not commercial viable or cost-effective for smaller installations.



- RICE are reliable, efficient, well-adapted to combined heat and power (CHP) installations, and can yield significant improvements in energy costs, emissions and security.
- Because of this, broad-based efforts are underway to develop advanced RICE systems for deployment in DE (e.g. ARES and ARICE programs).



- Despite the promising role for RICE in DE, recent state and national environmental rulemakings threaten to ban the use of RICE for DE applications before the pending development efforts can be implemented.
- The premises and consequences of such rulemakings are unreasonable and should be corrected.



- Coordinated efforts to develop well-reasoned regulatory programs for RICE in DE applications, including appropriate emission standards, are necessary.
- DOE, working in conjunction with EPA, state regulators, industry and other key stakeholders, needs to take a leading role in ensuring the implementation of well-reasoned optimized programs for RICE in DE applications.



#### Background Information: Feasibility of Emission Limits For RICE

- There is a fundamental disconnect between the emission limits mandated in recent regulatory initiatives and what is actually feasible for RICE in DE applications.
- Regulatory initiatives have focused on NOx emissions from RICE, since NOx can be a precursor to ozone formation.
- RICE can be categorized by fuel type: richburn natural gas, lean-burn natural gas, and diesel fuel.



### Background Information: Feasibility of Emission Limits For RICE

The near-term (2003 time frame) NOx emissions levels that may be technologically feasible for RICE, with and without aftertreatment, are as follows:

	Rich-Burn Natural Gas	Lean-Burn Natural Gas	Diesel-Fueled
Without Aftertreatment	34 lbs/MW-hr	4.7 lbs/MW-hr	20 lbs/MW-hr
Type of Aftertreatment	Two-stage, three- way catalyst with oxidation controls	Selective catalytic reduction systems with oxidation catalyst	Selective catalytic reduction systems with oxidation
With Aftertreatment	0.47 lbs/MW-hr	0.87 lbs/MW-hr	2.0 lbs/MW-hr



- Concerted Efforts are underway to bring about significant improvements in the performance of gaseous-fueled RICE.
- DOE is leading a coordinated collaborative effort to improve the efficiency, emissions performance, and overall costcompetitiveness of gaseous-fueled RICE in DE applications.



The DOE's Advanced Reciprocating Engines Systems (ARES) program has targeted the following "stretch goals" for gaseous-fueled RICE by 2010:

2010 ARES "Stretch Goals"

NOx emissions -- 0.3 lbs/MW-hr

Electrical efficiency -- 50%

Cost reductions -- 10%



- These stretch goals incorporate and reflect sound public policy from an energy and environmental perspective.
- DOE and engine manufacturers are committing significant resources toward implementing these stretch goals in a commercially viable manner by 2010.



- Recent unreasonable regulatory initiatives, however, are threatening the viability of the ARES program's goals, and could lead to a wasting of the significant resources that have been allocated to the attainment of those goals.
- Many of the recent unreasonable regulatory programs for RICE in DE applications appear to have a common root.



Two years ago, the Energy Foundation caused a report to be issued entitled: "Can We Have Our Cake and Eat It, Too?" Creating Distributed Generation Technology to Improve Air Quality" (the "Eat Cake Report").



The Energy Foundation is based in San Francisco and is backed by various charitable foundations and trusts. The Foundation's principal mission is to promote renewable energy. The Foundation regularly provides grants to the NRDC, EDF and Sierra Club.



The Eat Cake Report noted the "growing potential" [not current role] for small-scale DE and advocated:

"technology-forcing in the specific form of manufacturerbased regulation which would require, over time, the reduction of emissions from DG units at the point of manufacture as a means of ensuring greater air quality." (p.1.).



- The Eat Cake Report also made the following assumptions:
  - "it is assumed that the most likely power plant to by offset by DG is natural gas combined cycle electric generation" (p. 13).
  - "it is assumed that 70% of the central-station generation that would be displaced by DG will occur in urban airsheds" (<u>id</u>.)



- Based on such premises, the Eat Cake Report concluded that "only the direct oxidation fuel cell is competitive with combined cycle generation" (p. 14), and that "technologyforcing" regulations were required (p. 31).
- The Eat Cake Report advocated that "innovative DG policy at the state level now could lead to the desired national regulation over time." (p. 22.)



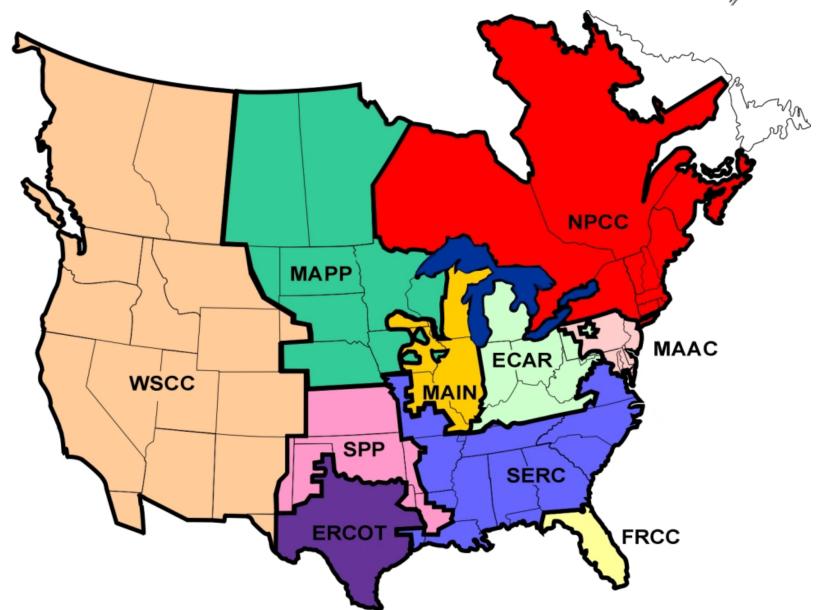
- The key premises behind the Eat Cake Report are not correct.
- It is <u>not</u> the case that combined cycle natural gas power plants (with NOx emission levels at 0.07 lbs/MW-hr) are the most likely power sources to be displaced by DE.



- The average power plant is <u>not</u> a combined cycle natural gas plant, and the average power plant NOx emissions (a much better measure of what is likely to be displaced by DE) are approximately 3.6-5.0 lbs/MW-hr -more than <u>70 times</u> the emissions rate assumed in the Eat Cake Report.
- Recent data from U.S. EPA confirms this.



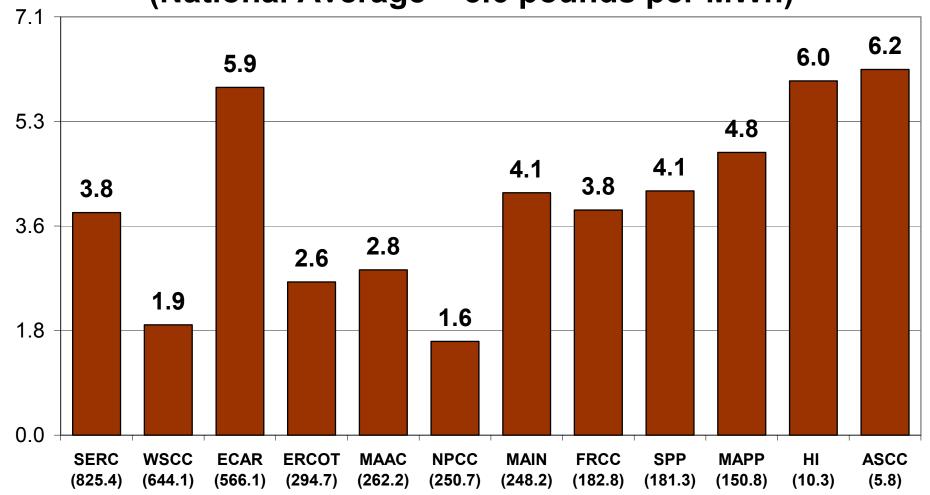








### 1998 Average NO<sub>x</sub> Emission Rate in pounds per MWh (National Average = 3.6 pounds per MWh)

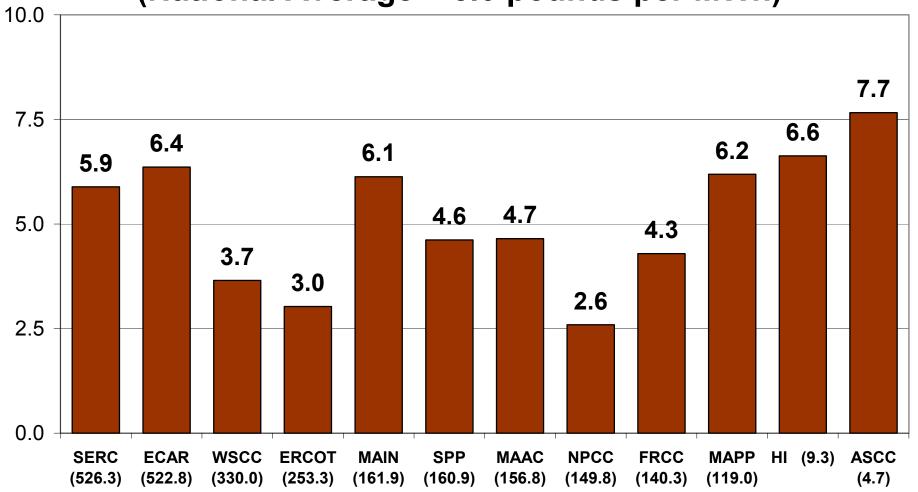


**NERC Region and Generation in TWh** 

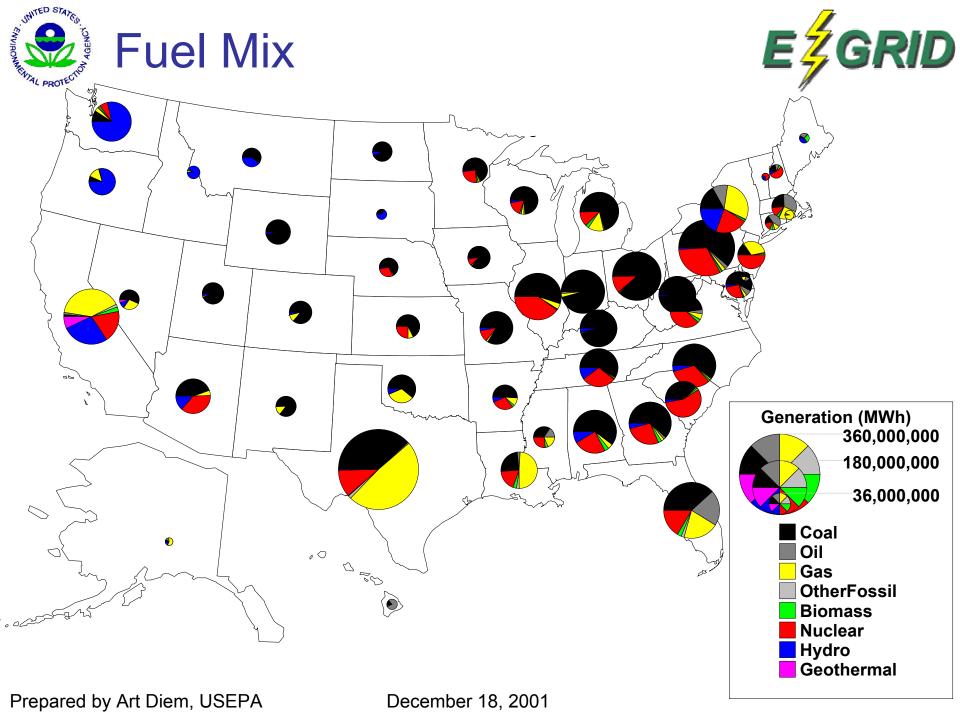


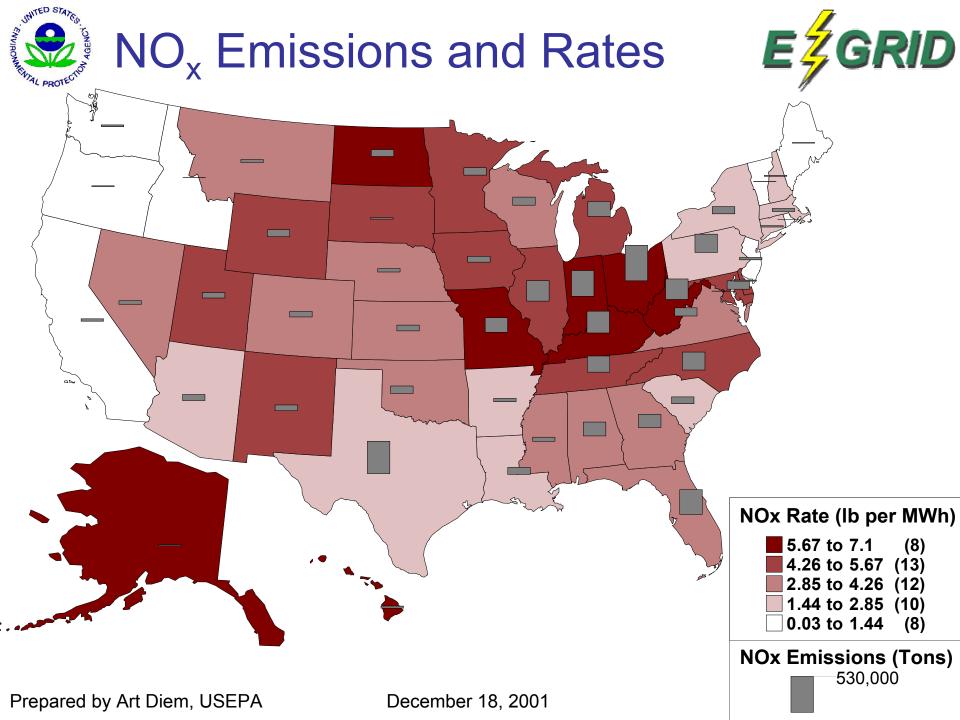


## 1998 Average NO<sub>x</sub> Emission Rate in lb/MWh (fossil only) (National Average = 5.0 pounds per MWh)



**NERC Region and Fossil Fuel Fired Generation in TWh** 







- Despite their fundamental inaccuracy, the premises of the Eat Cake Report (and similar advocacy efforts) are being promulgated and accepted.
- The State of California apparently relied upon the incorrect premises of the Eat Cake Report.



- In 2000, California enacted SB 1298, which mandated that emission standards for DE "by the earliest practicable date, shall be made equivalent to the level determined by the [ARB] to be [BACT] for permitted central station power plants in California [0.07 lbs/MW-hr]."
- In November of 2001, ARB adopted a regulation to implement SB 1298.



- Under the ARB rule, smaller scale DG units would need to meet a NOx limit of 0.07 lbs/MW-hr (0.02 g/bhp-hr) starting in 2007.
- ARB standard is 27 times more stringent than average power plant emissions in the Western region (1.9 lbs/MW-hr), 7.1 times more stringent than South Coast BACT limits for natural gas (rich burn) engines (0.5 lbs/MW-hr), and 4.3 times more stringent than ARES "stretch goal."



- The Staff Report for the ARB's DG rule conceded that "ARB staff is also aware that it will be difficult for some DG technologies such as reciprocating engines to ever meet BACT levels for central station power plants." (p.x.)
- Incredibly, the ARB Staff Report also noted that "DG technologies have not yet penetrated the California market and are not part of the inventory that is used for the State Implement Plan." (p. VII-2.)



Thus, the ARB rule essentially killed the prospect of advanced RICE in DG applications before those applications could even be developed.



- In May 2001, Texas adopted a "standard permit" for electric generating units to encourage the use of "clean" DG units of 10MW or less.
- The regulation divides the State in half (West Texas and East Texas) in recognition of the severe non-attainment issues faced by the Dallas and Houston metropolitan areas.

The TNRCC Summary Document described the rulemaking as follows:

"The West Texas standards represent BACT and should allow for clean reciprocating engines to register under the standard permit, as well as clean diesel engines operating as peaking units. The initial East Texas standards represent BACT recognizing the unique ozone problems in East Texas and should allow for authorization of fuel cells, microturbines, clean turbines using catalytic combustors or flue gas cleanup, and the very cleanest reciprocating engines using catalytic converters." (p. 3.)

### Recent State Initiatives: Texas Regulation

The Texas DG standards for NOx emissions can be summarized, as follows:

	West Texas 300 hrs or less/yr	West Texas more than 300 hrs/yr	East Texas 300 hrs or less/yr	East Texas more than 300 hours/yr
2001-2004	21 lbs/MW-hr	3.11 lbs/MW-hr	1.65 lbs/MW-hr	0.47 lbs/MW-hr
2005 and beyond	21 lbs/MW-hr	3.11 lbs/MW-hr	0.47 lbs/MW-hr	0.14 lbs/MW-hr



 Unlike the ARB regulation, the Texas rule does not completely eliminate RICE in DG applications before such applications can be fully developed (except for prime and intermediate power applications in East Texas starting in 2005).



- The prediction made in the Eat Cake Report is starting to come true: State (e.g. ARB) DE policy is beginning to take over national policy.
- Evidence of that has emerged through a program being overseen by the Regulatory Assistance Project (RAP).



- RAP is currently developing a draft "model rule" to regulate emissions from smaller-scale DE. This RAP effort is being funded by DOE.
- RAP's principals all served as regulatory officials and now work to foster "energy efficiency and renewable resources."



- RAP published a public review draft of its draft "model rule" in November of 2001.
- The working group that prepared the draft includes 21 state regulators, and 5 representatives of environmental advocacy groups -- including 3 officers of the Energy Foundation and the author of the Eat Cake Report.



Not surprisingly, one of the stated premises of the draft "model rule" is to "encourage technological improvements that reduce emissions output." (p. 14.) "This characteristic is commonly referred to as technology-forcing." (p. 21.)



- Like the ARB rulemaking that apparently guided the working group, the RAP draft would effectively preclude RICE in DE applications before the pending ARES development efforts could be implemented.
- The NOx emission standards that RAP put forward in its public review draft are as follows:



#### **RAP Draft NOx Standards**

	Emergency Generators	Peaking Generators (less than 700 hrs/yr)	Baseload Generators (more than 700 hrs/yr)
Phase One: 2003-2005	21 lbs/MW-hr	1.0 lbs/MW-hr	0.47 lbs/MW- hr
Phase Two: 2006-2008	17 lbs/MW-hr	0.60 lbs/mW-hr	0.27 lbs/MW-hr
Phase Three: 2009 and beyond	14 lbs/MW-hr	0.30 lbs/MW-hr	0.07 lbs/MW-hr



- Starting in 2006, the draft "model rule" would effectively ban the use of RICE, even gaseous-fueled RICE employing aftertreatment, in all "baseload" DE applications.
- The RAP rule also targets emission limits that are inconsistent with the ARES "stretch goals," and ultimately seeks to implement the ARB/Eat Cake standard of 0.07 lbs/MW-hr.



- Significantly, and unlike the TNRCC rule, the draft "model rule" makes no provision for whether an implementing jurisdiction is "attainment" or "non-attainment."
- The draft "model rule" also would establish limits for other pollutants (CO, CO<sub>2</sub> and PM) at levels that exacerbate the rule's infeasibility.



- Finally, the draft "model rule" makes no effort to establish cost-effectiveness (<u>Compare</u> CAA definition of "BACT" -- 42 U.S.C. §7479(3); BACT takes into account "energy, environmental and economic impacts and other costs.")
- RAP intends to finalize a draft model rule in June.



- Fundamental changes are required to the "model rule" before then.
- Otherwise, unreasonable premises will continue to engender unreasonable regulatory initiatives that undermine the development of advanced RICE for DE applications.
- A true "model rule" needs to foster not frustrate the goals of the ARES program.



- A true "model rule" also should not establish a fundamental disconnect between the technology it seeks to "force," on the one hand, and what is actually feasible and commercially viable, on the other hand.
- DOE and other affected stakeholders must act to ensure that the fundamental disconnects inherent in the recent regulatory initiatives are addressed and eliminated.